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ABSTRACT

At issue is the extent to which one can employ an adoption and diffusion of innovations model(s) to explain and predict the use of soil and water conservation practices. Much, however, can be gained from using models in this area. Four dimensions that should be present in any research design if it is to account for adoption and diffusion of conservation practices are the nature of the innovation, the characteristics of the adopting unit, the position of the adopting unit within the social system, and the characteristics of the social system. There is little disagreement that the nature of the innovation influences adoption and diffusion processes. There are no pre-packaged "conservation machines"; conservation is a blend from agronomy, engineering, economics, and, at times, superstition and luck. Although it is easy with hindsight to look back upon the adoption-diffusion model as it evolved in the 1950s and see shortcomings, it offered then, and now, a tremendous utility. Perhaps the major problem with this model is the researchers' tendency to accept the model at face value--to take it for what it is. Instead, this model, or any model, should be constantly challenged and modified to account for new situations and old criticisms. (BRR)

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# APPLICABILITY OF AN ADOPTION-DIFFUSION MODEL TO RESOURCE CONSERVATION: A SUPPORTING VIEW*

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# APPLICABILITY OF AN ADOPTION-DIFFUSION MODEL TO RESOURCE CONSERVATION: A SUPPORTING VIEW

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## INTRODUCTION

At issue is the extent to which one can employ an adoption and diffusion of innovations model(s) to explain and predict the use of soil and water conservation practices. A number of criticisms, many of these summarized by Warner (1974), Downs and Mohr (1976), Rogers (1976) and Goss (1979) have been directed toward what has been called the "traditional" model of innovation diffusion. In addition to these general criticisms, it has also been argued that this model has little applicability to the specific area of soil and water conservation (Pampel and van Es, 1977; Lovejoy and Parent, 1981). However, the position taken in this paper is that much can be gained from using these models in the area of soil and water conservation.

Initially this position will be developed by commenting on some criticisms directed toward research on the diffusion of innovations. The currency and validity of some of these criticisms are questioned by specifying how contemporary models differ from earlier efforts. Finally, the issue of whether an adoption-diffusion model can be applied to the area of resource conservation is transcended by demonstrating how it has been utilized. The paper concludes by strongly supporting further research with adoption and diffusion models in the area of resource conservation.

Criticisms of the Traditional Model

Two general observations can be made about the criticisms directed toward the traditional model of innovation adoption and diffusion. First, the critics often assume that this model is something well established, characterized by definitional consensus and bounded across time. In actuality there is a tremendous amount of variation in the assumptions, concepts and their relationships contained within different depictions of the model; that is, my version of the traditional model is unlikely to be the same as yours. This variability is especially evident in some of the classic attempts to synthesize the research in this area (compare the work of the North Central Rural Sociology Subcommittee on Diffusion of New Ideas and Farm Practices;[1] Lionberger, 1960; Rogers, 1962; Havelock, 1969; Rogers with Shoemaker, 1971; Brown, 1981). Relative to the critics, one must wonder which of these models they are criticizing. If their criticisms are to be of any value, then it is suggested that present and future critics begin by specifying what they mean by the traditional or classical model of innovation adoption and diffusion. Well-founded criticisms are needed to test and challenge the model, whereas vague, strawman arguments may only promote the fame of the critic. If that is their intent, then let us begin to recognize it as such.

A second observation is related to the role of research in the process of model generation. Although there is not a consensus on a definition of a model, most will agree that a model should at least lead to the development of a set of working hypotheses so that the utility of the model can be tested. Consequently the theory represented by this model would be influenced from the results of testing these hypotheses. Then, as these research findings accumulate, the model is adjusted accordingly. Nonetheless, many critics

expect contemporary researchers of innovation diffusion to work with a model which is fixed and constant through time. Their criticisms are often directed toward a model as it was initially formalized in the early 1950's failing to recognize that the model has continued to develop since that time. Even the semantics involved with referring to it as the "traditional" model invokes a well-known sociological bias in that the traditional (read as static and undeveloped) cannot compare to the modern (read as advanced and developed).

Yes, there is a research tradition in investigating the adoption and diffusion of innovations, but contemporary research cannot be characterized as a blind imitation of past efforts. More critics need to realize that contemporary researchers have evaluated these past efforts, the strengths as well as the faults, and adjusted their efforts accordingly. It is time to stop reciting the standard litany of criticisms of the adoption-diffusion model until one has made the effort to determine their current validity.

A Debate on the Innovation Diffusion Model

The debate as to whether we can use conservation practices as the innovation in an adoption-diffusion model is a false issue. The question should not be whether we can use the model, rather it should be one of determining the utility of this model in this particular research area. Ideally the utility will be evaluated through the presentation of an integrated set of research results representing different components and processes of the model. Those results are now being generated. Therefore I will not debate if we should apply it to this area. Instead I will explain how it is being applied, and at the same time, demonstrate how this application neutralizes some of the major criticisms against the model.

AN APPLICATION

It should not be necessary to document the resource exploitation and environmental degradation relative to our natural resources. It would be difficult to dispute the need for conservation. It would also be difficult to ignore the fact that many soil and water conservation practices have already been adopted and are being maintained. Conservation is an ongoing reality for many farmers[2], farm firms and agricultural organizations. This means that the essence of this debate is not to argue if they will adopt, rather it should be to compare explanations of the fact that they are already adopting the needed practices. After a careful examination of all that our discipline has to offer, I believe that an adoption and diffusion of innovations model offers the best possible explanation.

The Innovation

Why are soil and water conservation practices being adopted or rejected as innovations?[3] How do we explain the diffusion of these practices? The answer to both of these questions has to involve the character of the innovation itself. There is little disagreement that the nature of the innovation influences the adoption and diffusion processes. Yet one of the major criticisms of previous diffusion research was that it was based on a restrictive definition of an innovation. That is, the innovation was supposedly viewed as a single item of technology which was bounded and rigid through the diffusion process. Further, this immutable innovation was viewed as originating through a process of technological determinism in that it was introduced from outside the system of potential adopters while supposedly having productive, beneficial and positive consequences for all. These criticisms are not valid relative to current research in the area of resource conservation.

There are no pre-packaged 'conservation machines.' Nor are there any conservation 'cookbooks' or other forms of quick technological fixes. Conservation results from a system or process which involves the skillful blending of the old with the new. It is a blend from agronomy, engineering, economics, and at times, superstition and luck. Conservation is maintained by changing this blend to accomodate seasonal or managerial variations, e.g., what works in a dry year may not work in a wet one, and what works for one operator may be a total failure for another because of soil or managerial differences. There is nothing fixed, constant or monolithic about the innovations in the conservation arena. Therefore, instead of focusing on the innovation as it has been implemented, it is frequently necessary to examine the manipulation or re-invention of the innovation which occurs prior to its implementation. How do we account for this re-invention process (Rogers, 1978; Rice and Rogers, 1980)? Three different areas are currently being examined relative to the adoption of conservation practices:

1. The managerial ability of the operator. One cannot assume that all operators have access to equal resources or abilities when working with conservation systems. Rather than focusing only on the amount of resources available, a more important research question is determining what can be done with any given amount of resources. That is, to examine the interaction between resource availability and managerial ability. How are these related to the successful use of conservation systems? And, as will be noted later, one must also be concerned with the distribution of this ability relative to the manager's position within the larger social system.

2. The mutability of the innovation. Mutability refers to the degree to which the innovation itself can be changed. For example, an operator may shift to a reduced tillage system only if the present planter can be modified to remain stable in heavy residue situations. Or the method of injecting fertilizers and herbicides may also have to be modified on the planter. How does one conceptualize or measure mutability--the extent something old can be changed into something new, or the extent to which something new can be made different? How is this related to the notion of appropriate technology? Will research support the hypothesis that the degree of mutability of an item or practice is positively related to the extent of re-invention?

3. The adopting unit's position within indigenous knowledge systems. One quickly realizes that some of the most creative research being carried out on conservation innovations is not coming from the land grant colleges or the USDA conservation agencies. Farm operators, either through a process of invention or re-invention, often generate the practical answers that other operators are seeking. This generation and dissemination process does not appear to coincide with the more traditional opinion leaders (i.e., the two-step communication flow). If this is the case, then what is the relationship between these indigenous knowledge systems and the more formal knowledge systems in promoting the adoption of conservation practices? How does one measure an operator's position within an indigenous knowledge system?

These, of course, are only several of the many questions associated with the research in this area. However, it should be clear that conservation

innovations must be viewed as a dynamic entity. "Traditional" criticisms have little validity for the current research on these innovations. Perhaps it is time for a little innovativeness on the part of the critics.

Much of the corroborative research for the adoption-diffusion models has been derived from investigating innovations with a clear economic advantage. Thus, there is some question if these models can be applied to what has been called "unprofitable" innovations (Pampel and van Es, 1977). This challenge was made in specific reference to soil and water conservation practices.

The profitability argument relative to the adoption of conservation practices is an echo from the past (Griliches, 1957; Rogers and Havens, 1962). Here the critics are guilty of ignoring their own criticism. One of the deficiencies of previous research was to assume that a characteristic of an innovation had a similar influence on all potential adopters. But profitability, or any other characteristic of an innovation, is not a dichotomous attribute which has a universal application to a functional category of innovations (e.g., soil and water conservation practices either are or are not profitable). This is because profitability is not an intrinsic or primary attribute of an innovation, it is an extrinsic or secondary characteristic. Because of this, the profitability of an innovation is determined by the interaction of the innovation with the potential adopting unit as well as with the position of that unit within the larger social system. Of course the institutional context surrounding the development and promotion of the innovation also influences its potential profitability. Further, research in the areas of health, education, politics and religion all demonstrate that profitability may have little to do with the adoption of an innovation. When it comes to conservation, profitability is a variable and should be treated as such when studying different practices being considered for adoption. Profitability must be determined through research and not by proclamation.

Profitability is a narrow economic concept. It is something easily measured and communicated (much talked about), yet rarely related to the more general concept of utility. Utility relative to the adoption of conservation practices can include the economic as well as the social and agronomic benefits. All three--profitability, prestige and fertility and/or tilth--influence adoption and diffusion processes. Two different areas are currently being examined relative to utility in the adoption and diffusion of conservation practices:

1. The decision-making processes surrounding the trade-offs in utility. Contrary to common belief, potential adopters do not always trade off agronomic benefits for economic ones consequently rejecting conservation practices. Moreover some conservation practices have the potential to enhance profitability, prestige and stewardship. However, we cannot assume that the decision-making processes surrounding these three utilities are made in the same way for all potential adopters (Barlett, 1980). Therefore, how do decision-making styles vary when different conclusions are reached relative to similar sets of utilities? How do we account for these different decision-making styles? Again, this explanation should include characteristics of the adopting unit (personal, farm firm and ecological), the position of the adopting unit within the larger social system and the features of the social system itself.

2. Investigating how differences in the planning horizon influences these utility decisions. Adoption and diffusion models incorporate time as a crucial element. Research has established that the planning horizon influences the adoption of conservation practices. What

influences the development of an operator's planning horizon? Of course there are purely economic answers to this question, but there is also an important sociological dimension as well. The degree of integration to the land through kin and social networks has a powerful influence on planning horizon, and consequently the adoption of conservation practices. This factor, often represented by some measure of tenure, explains the trade-off of economic benefits on a short-term basis for long-term social and agronomic utilities. How can we better represent the degree of integration to the land through kin networks? For example, we know that those who rent land from kin are more conservation oriented than those who rent land from non-kin. Besides the type of kin involved (immediate versus extended family members), do the characteristics of the kin network (size, authority structure, wealth, position in community, etc.) influence conservation decision processes? Do these same factors explain any of the variation in the conservation behavior of owner-operators, or owner-operators versus renters?

Does the potential economic utility of an innovation influence its adoption and diffusion? Of course it does, but it is not the Rosetta stone for understanding conservation behavior. As demonstrated above, some of the questions generated by adoption-diffusion models offer a much richer, and perhaps from a policy perspective, a more fruitful method of explaining and predicting resource conservation. Why do individuals adopt or reject soil and water conservation practices? How do we explain the diffusion of these practices? We will not find the answer to these questions in simple responses based on a philosophy of economic determinism.

The Research Design

When the foundations of the models were initially being developed, questionnaires were often administered to a cross-section of individuals in an effort to determine how their social psychological orientations influenced adoption decisions. As a result we often hear that the models are based on a social psychological orientation which employs a behaviorist methodology while ignoring the consequences of the adoption decision. By now it should be clear that current research in the area of resource conservation has transcended these criticisms.

Four dimensions should be present in any research design if it is to account for the adoption and diffusion of conservation practices. These are the nature of the innovation, the characteristics of the adopting unit, the position of the adopting unit within the social system, and the characteristics of the social system. The nature of the innovation has already been alluded to in the previous section. Each of the remaining dimensions are briefly discussed below along with what are deemed to be relevant questions.

1. Characteristics of the adopting unit. The characteristics of the adopting unit refer to personal, farm firm and ecological factors. Correlational analysis has indicated that managerial ability, risk proneness and stewardship are three of the most important personal factors. Yet how can these empirical findings be interpreted in a theoretical framework--especially one compatible to an adoption-diffusion model? One working hypothesis is that stewardship is related to the integration to the land through kin and social networks as previously discussed. The normal explanation of risk and ability would relate it to socialization and other individual background factors. However, adoption research informs us that the decision-

making context--constraints as well as opportunities--should also influence expressions of risk and ability. Thus, it initially appears necessary to interpret risk and ability in the context of farm firm and ecological factors, that is, attempting to determine the need for risk and managerial ability based on economic and ecological characteristics. What is the nature of this relationship?

The adopting unit is not necessarily an individual. There are a number of organizational forms of the farm firm which go beyond the traditional family farm with its individual decision-maker. In these cases, and because more decision makers are involved, does this mean that the managerial ability of the firm also increases ("two heads are better than one")? Are these more complex farm firms also better able to absorb the consequences of risk-failure, and therefore they are more risk prone? If so, and because of the complexity and risk often involved with conservation systems, then these types of farm firms should be more likely to adopt. Is this the case?

All too often conservation research examines economic and social factors while ignoring the ecological context surrounding these decisions. It makes little sense to use personal and farm firm factors to explain adoption behavior without first controlling on the need for conservation; that is, the nature and strength of the factors influencing adoption decisions will vary between two identical farm firms, one on "hilly" ground and the other on "fairly flat" ground. Another problem with ignoring the ecological context is that it will result in the distortion of measures of the farm firm. It is common for research to classify farm firms on the basis

of the quantity of land owned, rented or operated. However, if we are going to accurately account for the adoption of conservation practices, then we must also consider the quality of that land (e.g., the Corn Suitability Rating, market value, or the RKLS coefficient of the Universal Soil Loss Equation). Quality of the land may be more important than quantity when explaining conservation behavior. It might also add an interesting twist to those efforts to create typologies of farming systems--land (quantity and quality), labor and capital.

2. The position of the adopting unity in the social system. Why are conservation practices adopted or rejected? Individual resistance can be important, but a more likely explanation is represented by the constraints and opportunities associated with the adopting units position within a social system. Research is attempting to determine the relationship of some of the previously discussed factors to the position of the adopting unit. Do higher status farmers have higher levels of managerial ability? What is the relation between status and position with indigenous versus "conventional" knowledge systems? Do higher status farmers operate the better land (less need for conservation) while also receiving a disproportionate share of institutional support (cost-sharing monies and tax benefits)? Or, what is the relation between time of adoption and status (Cancian, 1967; 1972)? Following the Cancian thesis, is the notion of risk-averse behavior during the initial stages of diffusion consistent with the previous hypotheses concerning upper middle class farmers? Would the processes in the Cancian thesis be exacerbated or retarded with a more risky innovation as represented in some reduced tillage systems?

What about the differential consequences of adoption or non-adoption of conservation practices (Goss, 1979)? If higher status farmers are on the better land while also being more likely to adopt, then what are the long-term ecological consequences for lower status farmers? Other differential consequences of adoption associated with position are specified in the next section.

3. The characteristics of the social system. Tenure, or the linkage to the land, has been presented as an important factor in explaining conservation behavior. On a societal level the distribution of tenure categories within agriculture has been changing as evidenced by the increasing number of renter-operators and absentee landlords. Not only is the number of absentee landlords increasing, but the features of these positions also appear to be changing. The stereotype of the absentee landlord is the retired farmer, the farm widow or urban members of the family. Yet it appears, and this is a research question, that complex organizations are surpassing individuals in this category. Farm management firms who serve as intermediaries for distant kin and financial institutions, farm managers who are hired by non-farm members of incorporated farms, and availability of custom farming, computerized farm services and efficient communication allows management of a farm from a distance. All this works against the integration to the land through social networks. If we are going to explain the diffusion of conservation, then these structural considerations of our agricultural sector must be considered.

Another research issue could examine the structural consequences of promoting the adoption and diffusion of conservation practices.

As mentioned earlier, risk appears to be a major impediment to the adoption of conservation practices. If policy were designed and implemented to reduce that risk, then we could expect several structural consequences. It is hypothesized that the number of small and large farms (the ends of the distribution) would increase due to the time and labor savings often associated with conservation systems. Small farmers would use this time to continue to pursue off-farm employment whereas larger farms would use these resources in expansionary efforts. It would probably exacerbate existing trends while putting more pressure on middle-sized farms. Another hypothesis would be that we would see an increasing specialization of cash grain farms. The complexity and special equipment needs of some reduced tillage systems will probably restrict diversification into other commodity areas. Both of these trends will probably have their greatest impact in the Corn Belt region because of existing structural characteristics.

Most of these statements are speculative and not supported with data. Data which would have to be generated using a variety of methodology. They are largely questions, hypotheses and guesses generated in attempting to explain the adoption and diffusion of conservation practices. They are, in fact, an expression of the utility of the model.

## CONCLUSION

The following statements are presented as a means of summarizing current research efforts which are examining the adoption and diffusion of conservation practices:

--Research is not based on a social psychological orientation, but attempts to incorporate relevant dimensions of the social and ecological context at several levels of analysis.

--Research is not based on an assumption of a trickle-down communication process, but instead recognizes the importance of interactive communication processes as well as the viability of indigenous knowledge systems.

--Research does not use a restrictive definition of innovation, but instead recognizes the variability in the manipulation and re-shaping of this innovation to meet the needs of the adopting unit.

--Research does not assume a universal applicability of an innovation, but treats this as a research question.

--Research in this area is not research-driven, but instead focuses on client needs and problems, again at several levels of analysis.

--Research does not end with the adoption decision, but also focuses on the social and ecological consequences of these decisions.

--Research findings have not emphasized individual resistance in explaining the failure to adopt, but examines opportunity and obstacles as equally viable explanations.

--Research has not been totally dependent on behavioralist methodologies, but has recognized that other methodologies may be equally important depending on the circumstances.

Although it is easy with hindsight to look back upon the model as it evolved in the '50s and see shortcomings, it offered a tremendous utility then as it does now. Perhaps the major fault of the model is the tendency to accept the model at face value...to take it for what it is. Instead, this model, or any model, should be constantly challenged and modified to account

for new situations and old criticisms. The research becomes more complex, and the answers are not as quick in coming, but that does not mean the model lacks utility. Just as the model explains the adoption and diffusion of innovations, the proponents of the model must also become innovative in continuing to extract the utility from the model. Is the adoption-diffusion model in "crisis" (Hooks, 1980)? Hardly; as long as a model's proponents can respond to constructive criticisms, as long as the model's utility can be demonstrated in new ways or areas, such as resource conservation, then the model has a continuing role in the social sciences.

In conclusion, debating the model's applicability was the easy part, demonstrating it's utility will be more difficult. However, remember that explaining the adoption and diffusion of hybrid seed corn was also considered difficult at one time.

## FOOTNOTES

1. Perhaps the most popular publication from this subcommittee was "How Farm People Accept New Ideas" (North Central Regional Publication No. 1, 1955). Although the composition of this group changed across time, the following people are commonly associated with these early efforts; A. Lee Coleman, C. Milton Coughenour, Joe Bohlen, Herb Lionberger, E. A. Wilkening, Robert Dimit, and Everett Rogers. If there ever was a traditional model, then it was probably the regional publications developed by this group. However, from these early consensual efforts, most went on to develop independent, and often unique, research programs in this area.

2. The term farmers will be used in a generic sense to refer to those individuals who are directly dependent on natural resources to produce an income. Thus we could also discuss the conservation practices associated with loggers, miners, ranchers, etc.

3. Some conservation practices are quite "old." However, it has been argued elsewhere (Nowak and Korsching, 1979:7-8), they can also be considered innovations because of a new organization of the cultural items surrounding these technologies.

> "Many of the existing conservation practices were originally developed in the 1930s and 1940s to facilitate the maintenance of the soil's natural fertility. The prevention of soil erosion was viewed at that time as a technique promoting a profitable farm operation. However, in the present agricultural sphere, the adoption of modern fertilizers, nutrients and other forms of soil enrichment has apparently diminished the need for the maintenance of natural soil productivity, at least on a short-term basis. As a result, the agricultural conservation practices of the '30s and '40s are now being presented to the farmer, not as a means to preserve natural soil productivity, but as a means of preventing soil erosion, sedimentation, water pollution and the destruction of aquatic recreation sites. In other words, originally, the conservation practices were presented to the farmer in the context of facilitating a successful farm operation, but now with current environmental concerns, the same practices are being presented to the farmer in the context of preventing some secondary effects of a farm operation, i.e., pollution."

In essence many old practices are being perceived as new because the cultural context has changed.

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